

CONSOLIDATION

Over the last two years, mergers and competitive alliances have transformed the competitive landscape of the telecommunications market. Several of these mergers involve CAPs and long distance carriers that compete directly with U S WEST and will dramatically affect its market position over the next several years.

MCI/MFS WORLDCom

The first major merger announced in 1997 (involving U S WEST competitors) was a union of MCI Communications of Washington, D.C. and WorldCom of Jackson, MS. The merger follows WorldCom's 1996 acquisition of Metropolitan Fiber Systems (a facilities-based competitor of U S WEST in the Phoenix area) and its 1997 acquisition of Brooks Fiber Properties. Additionally, MFS has already acquired national ISP UUNET in 1996 before its acquisition by WorldCom. The combined entity will have enormous market power in Phoenix and the United States as a whole. It combines the nation's second and fourth largest long distance companies, a major provider of competitive local communications services, and the two largest internet backbone operators in the world.

When the merger is complete (projected to happen in the third quarter of 1998), MCI WorldCom's sphere of influence in the Phoenix MSA will increase dramatically. The combined facilities will result in:

- Over 100 route miles of local fiber (including WorldCom's 75 route mile backbone and MCI's 20-30 miles)
- Two central office switches
- 70-100 "lit" buildings
- Several long-distance POPs and switches

With this merger MCI WorldCom will be able to decrease its reliance on U S WEST's services and facilities. Currently, U S WEST provisions hundred of high capacity circuits linking MCI long distance customers to the MCI POP in Phoenix. However, it will have the option of moving a large percentage of this traffic over to WorldCom facilities - resulting in a substantial reduction in MCI's costs. Because WorldCom has connected numerous buildings to its Phoenix-area network, MCI will have the option of providing true facilities-based service on a large-scale basis through the utilization of WorldCom facilities. MCI may also further decrease its reliance on U S WEST's facilities which supply the infrastructure used for the origination and termination of long-distance calls by migrating transport traffic from U S WEST-provisioned circuits to WorldCom's facilities, resulting in a reduction in MCI's operating costs as well as a reduction in U S WEST's access revenues.

Additionally, the two companies have an apparent synergy that will strengthen the merged carrier and allow it to impact the market quickly. Because WorldCom's traditional market consists of smaller and medium-sized businesses while MCI tends to focus on the large business market, there will be minimal overlap in sales forces and a less complicated integration of operations.

AT&T/TCG

Also in 1997, AT&T and TCG announced a merger that analysts expect to be complete by the end of the third quarter of this year. The acquisition provides AT&T with an easy, rapid entrance to the facilities-based local exchange and High Capacity Markets. TCG becomes the recipient of a well-established sales channel to increase its switched services customer base.

In a manner similar to the MCI/WorldCom merger, there is an apparent synergy between AT&T and TCG. Traditionally, TCG has directed its marketing efforts toward the large business market, and rapidly accumulated a customer list laden with Fortune 500 companies. Conversely, AT&T's recent strengths have been the small business and consumer markets. With the merger, AT&T will be poised to reassert its influence among large business customers and TCG will expand its penetration to include the small business market. TCG will also acquire additional resources from the merger to allocate for network expansion in the Phoenix MSA.

Like MCI, AT&T stands to benefit significantly from the merger in that it will undoubtedly lead to a reduction in operating costs in its core business - long distance. AT&T will be able to reduce its reliance on U S WEST for high capacity circuits to AT&T's customers, transport, and switched access, further reducing U S WEST's infrastructure revenues.

COMPETITORS AT A GLANCE

The following matrices provide summary information for high capacity facilities-based competitors in the Phoenix MSA. For additional information please refer to the appendix attached.

	WorldCom	TCG	MCI
Overall Strategy	One-stop provider for communications services, including local exchange, HICAP, data, internet, long-distance.	Leading provider of communications solutions to businesses. Service packages include local, data, long-distance, HICAP.	One-stop, single billing for businesses. Services include local, long-distance, HICAP, data.
Approximate Route Miles	75	>300	20-40
On-net Buildings	>50	>150	25-35
Central Office Switching	Nortel DMS 500	Lucent 5ESS	Nortel DMS 500
Network Establishment	2Q95	2Q94	1996
Business Target Markets	Traditional focus on the middle market. Seeks national accounts, solicits to other tenants in on-net buildings. Focus on existing WorldCom, UUNET customers.	Traditional focus on high-end users, now moving "down-market." Most TCG customers have enormous communications needs.	Traditional focus on large businesses. Relies heavily on existing L.D. customer base. Reputation for outstanding customer service.
Residential Target Markets	Not actively targeting	Not actively targeting	Not actively targeting
Geographic Areas	Phoenix's central business district, Camelback/Lincoln areas, Tempe, Scottsdale, and the Sky Harbor Airport	Area wide. Central Phoenix, Camelback, Scottsdale, Tempe, Mesa, Chandler, Glendale, Paradise Valley, Phoenix Sky Harbor Intl. Airport, Tolleson	Fiber is located in Phoenix's central business district (although MCI provides services in Mesa, Scottsdale, and Tempe via resale and use of U S WEST facilities)
Competitive Alliances	Pending merger with MCI to form MCI WorldCom	Pending merger with AT&T	Pending merger with WorldCom to form MCI WorldCom

(Continued on next page)

COMPETITORS AT A GLANCE

	ELI	GST
Overall Strategy	Provider of diversified communications services, including local, L.D., HICAP and data services	Provider of integrated communications services - DS-0 through OC-N, data services, local exchange, ISDN
Approximate Route Miles	400	11 miles in downtown Phoenix with an additional 18 miles of right-of-way and conduit available for expansion. 300 Route miles of fiber in the state of Arizona
On-net Buildings	30-45	15-25
Central Office Switching	Nortel DMS 500	Nortel DMS 500
Network Establishment	1995	1996
Business Target Markets	Middle market and high-end users, ISPs.	All business customers, large and small.
Residential Target Markets	Not currently targeting	Not currently targeting
Geographic Areas	Throughout the metropolitan area. Central Phoenix, Tempe, Mesa, Chandler, Glendale, Paradise Valley, Tolleson, Gilbert.	Downtown Phoenix and Southern Arizona
Competitive Alliances	Partnership with Salt River Project (local utility provider) in Phoenix	Formed Phoenix Fiber Access with ICG in 1995. Purchased ICG half in 1997.

COMPETITOR CAPACITY

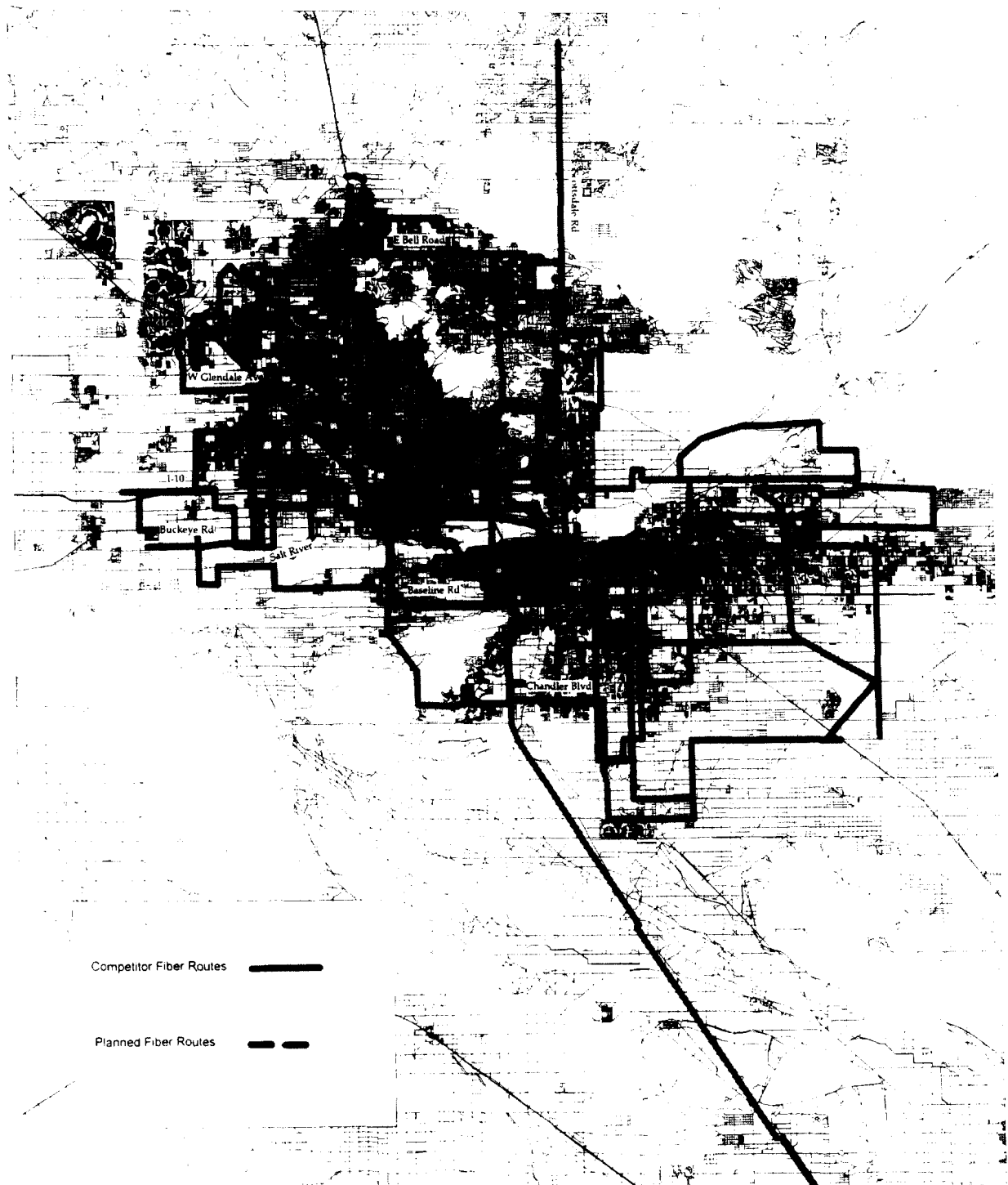
In recent years, U S WEST has become particularly vulnerable to losing additional Provider Market share due to the relative ease of switching providers (from both the wholesale and retail perspectives). During the initial infrastructure deployment, CAPs overbuilt their networks to meet the anticipated bandwidth demands of the future. Therefore, CAP networks are equipped with significantly more capacity than is currently being utilized. In fact, many industry analysts feel that several competitors are using only a small fraction of theoretical network capacity at the present time.

Two facets of CAP network construction generally contribute to their enormous capacity: 1.) the use of 144 strand optical fiber cable and 2.) adherence to SONET ring architecture. By using 144 strand cables, CAPs are capable of operating 36 "systems" across their networks (assuming a system is comprised of 4 individual fiber strands). The use of SONET ring network architecture allows CAPs to install self-healing rings that are connected, yet function independently - thereby increasing overall network capacity as rings are added to the network. Because CAPs have made several capacity allowances in the construction of their metropolitan area networks, they are able to grow and add circuits without necessitating frequent upgrades. In other words, there is a low marginal cost (from a capacity standpoint) associated with adding customers and circuits. To further facilitate the migration of traffic from RBOC facilities to competitive networks, CAPs frequently waive installation charges for new circuits.

As is the case with Provider high capacity circuits, CAPs will have little difficulty assuming Transport traffic from IXCs and other carriers. Generally, CAPs install extraordinary amounts of capacity around long distance POPs, U S WEST central offices, and competitive switching centers because of the enormous amount of traffic that originates and terminates at these facilities. In all likelihood, only a fraction of that capacity is currently being utilized and CAPs have the capability to assume Transport circuits without upgrading network capacity.

See the following page for a map of the competitor fiber routes.

Phoenix - Competitor Fiber Routes



Several factors contribute to network capacity, including the type of fiber used, transmission software, the number of SONET rings deployed, and the number of nodes in operation. The following table is designed to provide the basic competitor facilities that contribute to the overall capacity of a network. According to QUALITY STRATEGIES estimates based on U S WEST-supplied aggregate data (including DS-1, DS-3, and optical circuits used for end user traffic and transport), U S WEST currently operates approximately 85,700 DS-1 equivalents. The existing CAP networks could easily handle all U S WEST traffic (including optical circuits) by having only three systems activated in each CAP network (or less than 8% of total capacity).

In this case, we are defining a system as consisting of four individual fibers. Since CAPs generally install 144 strand fiber in their backbones, it is possible to have 36 systems under this arrangement. Assuming that each fiber ring runs at optical speeds (OC-3 through OC-48) and that all backbone rings are comprised of 144 strand fiber, the competitive networks in Phoenix (taken together) could handle all U S West traffic at less than 8% capacity. Please refer to the table below for a detailed description of CAP capacity in Phoenix.

Network capacity estimates are calculated based on the following inputs: Backbone speeds (which vary from ring to ring), and the number of SONET rings. The number of equipment sites was not taken into account for the calculation of network capacity. Please refer to the following page for a table illustrating competitive network capacity.

COMPETITOR CAPACITY

	<u>TCG</u>	<u>WorldCom</u>	<u>MCI</u>	<u>ELI</u>	<u>GST</u>	<u>Total</u>
Maximum Backbone Speed (in OC-n)	48	48	48	48	48	N/A
Approximate Percentage Operating at OC-48	75%	100%	100%	80%	75%	N/A
Other Backbone Speed (in OC-n)	12	0	0	12	12	N/A
Approximate Percentage Operating at that Speed	20%	0%	0%	20%	20%	N/A
Other Backbone Speed (in OC-n)	3	0	0	0	3	N/A
Approximate Percentage Operating at that Speed	5%	0%	0%	0%	5%	N/A
Average Backbone Speed (in OC-n)	38.55	48.00	48.00	40.80	38.55	N/A
SONET Rings operational in network	10	4	3	7	3	27
Approximate Capacity in OC-n	386	192	144	286	116	1,123
Approximate Capacity in DS-1 Equivalents*	10,794	5,376	4,032	7,997	3,238	31,437
Capacity Assuming 1 Systems	10,794	5,376	4,032	7,997	3,238	31,437
Capacity Assuming 3 Systems	32,382	16,128	12,096	23,990	9,715	94,311
Capacity Assuming 5 Systems	53,970	26,880	20,160	39,984	16,191	157,185

*Note: Approximate Capacity in DS-1 Equivalents is calculated by multiplying the above OC-n value by 28.

The average backbone speed of each competitor's network is derived by using the weighted averages of the various network speeds used in their network. The average backbone speed is then multiplied by the number of SONET rings operating in the network. The product is then multiplied by 28 to get the DS-1 equivalent. Examples of capacity are therefore provided based on the assumptions regarding the number of operational systems.

CONCLUSIONS

To date, U S WEST has lost approximately 23% of the High Capacity Market. This market includes both the Provider Market (consisting of special access and point to point circuits) and the Transport Market (consisting of circuits connecting POPs and local exchange COs).

Currently, U S WEST's share of the Provider Market is approximately 72%; down from 94% in the fourth quarter of 1994. Competitors have chipped away at U S WEST's market share through facilities buildout and alliances with interexchange carriers. Traditionally, U S WEST's facilities-based competitors have targeted its most valuable accounts - bandwidth-intensive large businesses. Because of this, CAP competitors have captured a greater percentage of the DS-3 (45 Mbps) market than the DS-1 (1.5 Mbps) market.

From a retail perspective, U S WEST maintains a billing relationship with fewer than 30% of all high capacity circuits. In other words, CAPs and IXC's maintain the end user relationship for 70% of special access high capacity circuits despite the fact that U S WEST currently provisions over 70% of these circuits.

While U S WEST's share of the Transport and Wholesale Markets are higher than its share of the Provider Market, recent incremental losses indicate that the figures may achieve parity in the near future. As of the fourth quarter of 1997, U S WEST accounts for 84% of the Transport market, down from 94% in the second quarter of the same year (six months earlier). Along the same lines, U S WEST's share of the Wholesale Market had dropped to 79% in fourth quarter 1997. Much of this share loss can be attributed to the realignment of carriers and an IXC desire to minimize the amount of business it conducts with U S WEST.

There is every indication that erosion of U S WEST's share of the Phoenix High Capacity Market will continue. Both U S WEST's relatively low Retail Market share and the enormous amount of unused capacity in competitive networks make it highly likely that U S WEST's share of the Provider and Transport Markets will continue to decline. This decline is expected to be exacerbated by continued consolidation in the telecommunications industry (e.g., the merger of AT&T and TCG).

APPENDIX

METHODOLOGY OVERVIEW

MARKET SHARE SUMMARY OVERVIEW

Market share results for Provider and Retail Market are based on actual usage obtained from surveys and invoice analyses. Market share results for this project are based on customer usage as of the fourth quarter of 1997. The following steps illustrate our process for delivering end user Provider and Retail market share results for U S WEST:

STEP 1: COMPETITOR AND INDUSTRY ANALYSES

Multiple inputs to sampling approach and sample plan, including competitor research, proprietary regional and national databases, and pre-survey screeners.

STEP 2: ESTABLISH SAMPLE PLAN AND QUOTAS

Develop preliminary market share estimates, establish quotas for appropriate strata, including high penetration and low penetration strata, and sub-strata (demographics, spending levels, etc.).

STEP 3: DEVELOP AND SELECT SAMPLE

Develop and select stratified random sample from sampling frame constructed from multiple sources, including third-party lists of businesses and proprietary databases.

STEP 4: CONDUCT FIELDWORK

Collect survey data and invoices. Based on the quotas established in the sampling plan, we conduct fieldwork to collect three inputs - short form surveys, long form surveys, and invoices - on which market share results ultimately are developed.

Achieve quotas for strata, and supplement with additional interviews for low incidence strata. Calibrate self-reported data with appropriate invoice bias factors.

STEP 5: ANALYSIS AND REPORTING

Analyze survey data and invoice data, and develop final results.

SAMPLING METHODOLOGIES

We develop our sampling plan using stratified random sampling techniques, which provide for efficient statistical estimates by designing the sampling plan based on particular strata (e.g., mix of utilization of competitors, demographic characteristics, geographic location, etc.) that we have developed and successfully applied over the past ten years. We utilize a mix of random and targeted surveys based on the stratified random sampling techniques. We use the random surveys to qualify respondents for different quotas established in our sampling plans. We also use the data obtained in the random surveys to establish weights for different strata when we reconstitute market share results.

SOURCES OF MARKET SHARE DATA

Market share results are based on data acquired from multiple sources, including surveys, customer invoices, and competitor research. We use our standard HICAP survey to collect data from business customers. QUALITY STRATEGIES surveyed business customers regarding their usage of high capacity DS-1 and DS-3 services. The survey includes questions on all competitive DS-1 and DS-3 services, including CAP fiber-based services, microwave services, satellite services, and customer-owned facilities. We also use surveys to collect demographic information, perception data, and other information not available on customer invoices.

We acquire customer invoices (RBOC, CLEC, CAP, IXC, and other competitive services) to provide market share results that are based on actual customer usage. We collect customer invoices to validate self-reported data and to calibrate reconstituted market share results based on actual customer expenditures and to correct for over- and under-reporting. On an aggregate basis, we analyze differences between survey and invoice data to develop and utilize bias estimates when calculating market share results.

STATISTICAL VALIDITY

This project is designed to provide estimates of high capacity (DS-1 and DS-3) share that are statistically valid for U S WEST's overall high capacity services compared to competitive alternatives. Sample sizes are designed to achieve statistically valid market share results for the Phoenix MSA.

High capacity (Provider and Retail) market share results for the Phoenix MSA are based on a 95% confidence level with $\pm 5\%$ margins of error. Estimates for particular types of high capacity services (i.e., disaggregated results) are likely to have a higher margin of error. Trend results are based on a consistent methodology across time periods.

COMPETITOR RESEARCH OVERVIEW

The competitive analysis is comprised of information gathered by QUALITY STRATEGIES' analysts for two separate "CAP/CLEC Network Descriptions" projects commissioned by U S WEST in the third and fourth quarters, 1997. Competitive information is gathered from numerous sources (both primary and secondary) including the following:

- Interviews with CAP/CLEC and IXC professionals, including marketing, sales, administrative, executive, and technical personnel
- Interviews with large business end users
- Interviews with equipment vendors and equipment retailers
- Secondary market research including on-line sources and public information
- QUALITY STRATEGIES' extensive, national competitor database that has been maintained and updated continuously over the last ten years

HIGH CAPACITY MARKET SHARE

High Capacity Market share is based on all end-user DS-1 and DS-3 services, including Special Access and Point-to-Point (exchange) circuits as well as transport circuits (measured in DS-1 equivalents).

Prior to 2Q97, Quality Strategies had been providing U S WEST with HICAP Track results for providers offering facilities-based service. Thus, no resellers have been included in Provider Market results. Since 2Q97, Quality Strategies has been presenting Provider results in addition to Wholesale and Retail Market results. Each set of results is clearly documented to indicate whether it encompasses facilities-based provider results, retail results that include resellers, or wholesale results.

QUALITY STRATEGIES uses DS-1 equivalents as the basis for market share estimates. Market share is provided for each service provider in terms of the percentage of DS-1 equivalents provided. Specific steps used to determine DS-1 equivalent share for each competitive category are as follows:

A. Determination of DS-1 Equivalents. High Capacity market share is provided on a DS-1 equivalent basis. All circuits are expressed in terms of 1.544 Mbps. QUALITY STRATEGIES uses the following calculations to determine DS-1 equivalent share:

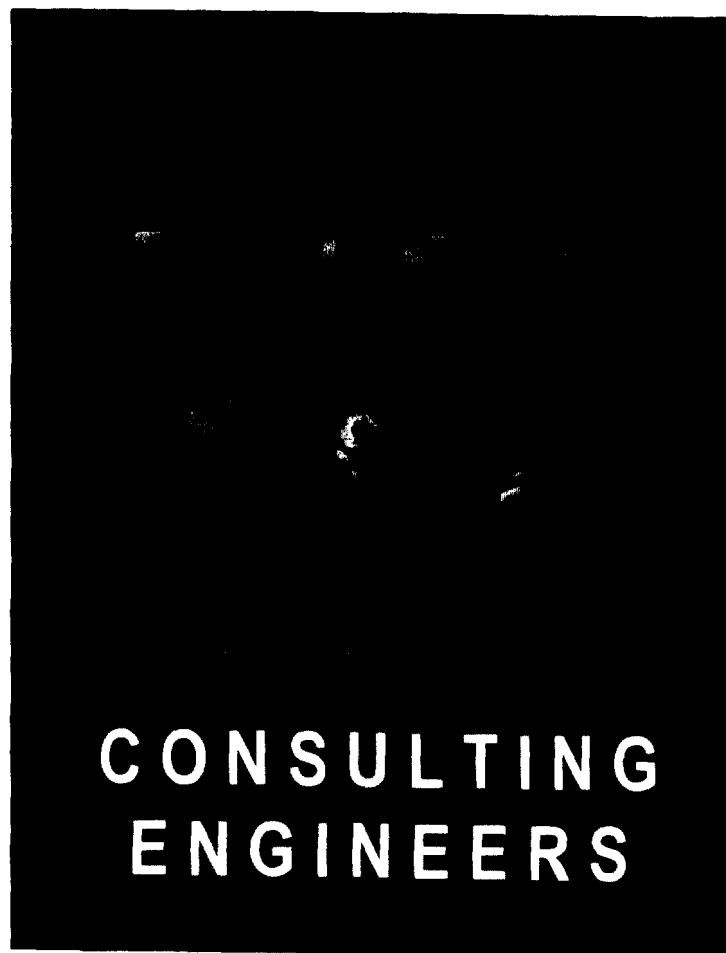
- One (T-1) DS-1 Circuit = One DS-1 Equivalent
- (T-3) DS-3 Circuits: Number of DS-3 Circuits x 28 = Number of DS-1 Equivalents

B. Determination of DS-1 Equivalents Percentage Share. DS-1 equivalents are totaled, and share is presented based on the percentage of the total each carrier provides.

Retail v. Wholesale. As stated previously, retail circuits are sold to end users. Wholesale circuits are provided to CAP/CLECs and IXC's for resale to end users. For example, a U S West circuit could be sold to AT&T (and paid for by AT&T), but resold to AT&T long-distance customers for special access to the AT&T POP. In this case, the end user is billed by AT&T although the circuit is provisioned and maintained by U S West. In this scenario, U S West receives Provider and Wholesale Market share for the circuit while AT&T receives Retail Market credit. Share of the Wholesale Market includes both end-user and transport circuits.

QUALITY STRATEGIES provides market share estimates based on DS-1 equivalents. Market share is provided for each service provider in terms of percentage of DS-1 equivalents provided.

ATTACHMENT B



DENVER

COMMUNICATIONS ENGINEERING SERVICES

PHOENIX COST STUDY & MODEL

PHOENIX FIBER STUDY
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EXECUTIVE SUMMARY

POWER Engineers, Inc. (PEI) has developed a cost model for the purpose of estimating the construction and equipment costs for Competitive Access Providers (CAPs) in the Phoenix, Arizona MSA, to displace existing U S WEST Communications (U S WEST) hi-cap services (DSL and greater bandwidth). The model estimates the cost of extending fiber-optic cable links from existing CAP backbone fiber routes to current U S WEST hi-cap customer locations (locations), based upon the airline distance from the location to the nearest CAP route. The model also includes the equipment and labor costs to terminate circuits at the locations, duplicating the service level now provided by U S WEST.

Major cost elements in the model are:

Structure costs - the aerial line or buried conduit path for the cable.

Access costs - to access the CAP fiber cable and the customer building.

Cable costs - including installation from the customer location to the CAP fiber route.

Equipment costs - including installation at the customer location plus incremental items needed at the CAP hub.

The model provides "broad-gauge" costs, sufficiently accurate for capital budget planning for constructing connections to a large number of locations, but not suitable for site specific costs. To develop the cost model, costs were divided into distance sensitive elements, such as the length of the fiber cable for each location, and non-distance sensitive elements (at the distances assumed in this study), such as transmission equipment.

Distance sensitive cost factors were developed by grouping locations into distance bands by airline distance from the nearest CAP fiber route. Then a random, statistically valid sample of locations in each band was surveyed. Probable paths to the CAP routes were determined and distances were measured for each sample. Physical factors which contribute to costs were noted, such as type of structure (aerial or below ground), surface or aerial line conditions, etc. Detailed cost estimates were developed for each sample location. Average path costs per location by distance band for the locations in the sample were computed for application to the total population of U S WEST service locations. Path costs were calculated on the basis of a single entrance path to each customer location.

Non-distance sensitive cost algorithms, consisting of equipment costs including installation, were developed on the basis of the type and number of services provided. Automatic alternate route protection was assumed where service requirements exceeded three DSL's. This provides switching to an alternate path on the backbone fiber ring, should a failure occur on the primary backbone path.

Estimates of construction time per location were also developed. The average time per location is estimated to be two weeks. Considering probable actions by local governments to minimize traffic disruptions and other public inconveniences, it is estimated that a 100% buildout would require

two-and-a-half to three years. A build, which took in the 49% of customer locations within 1,000 feet of an existing CAP fiber route, is estimated to require one-and-a-half to two years.

An assessment was also made of the wireless alternative for providing hi-cap services.

Cost Model results are summarized in the table below:

DISTANCE BAND (IN FEET) FROM NEAREST CAP FIBER ROUTE	NUMBER OF LOCATIONS WITHIN THE BAND	% OF TOTAL LOCATIONS WITHIN THIS BAND	AVERAGE COST PER LOCATION	TOTAL COST FOR ALL LOCATIONS IN THE BAND
0 TO 1,000	1,508	48.63%	\$29,596	\$44,631,239
1,001 TO 2,000	578	18.64%	\$33,211	\$19,195,750
2,001 TO 4,000	561	18.09%	\$54,667	\$30,668,367
4,001 TO 9,000	454	14.64%	\$71,126	\$32,291,231
ALL LOCATIONS	3,101	100%	\$40,886	\$126,786,587

II

STUDY OBJECTIVES

A. Fiber-Optic Cable Costs:

Develop a broad-gauge engineering assessment of the costs for Competitive Access Providers (CAPs) in the Phoenix, Arizona MSA. to displace existing U S WEST hi-cap services (DS1, DS3, OC-3, OC-12, OC-48) by extending fiber-optic cable links from existing CAP fiber routes to current U S WEST hi-cap customer locations (locations). This includes the provision of automatic, alternate routing where service requirements exceed three DS1's.

B. Wireless Transmission:

Review the potential for CAPS to utilize wireless transmission as an alternative means of providing hi-cap services.

III

ESTIMATING METHODS AND ASSUMPTIONS FIBER-OPTIC PATH COSTS

TASK:

Develop a broad gauge engineering assessment of the costs for the path from a customer location to the nearest CAP fiber cable route.

DESCRIPTION:

These are the costs from each location to the nearest access point on the nearest CAP fiber route. This includes the cost of the structure, which carries the fiber-optic cable, the cost of the cable, and the cost of placing and splicing the cable.

The cost of the structure is the largest cost element. Many variables determine structure costs, the most significant being the distance and the type of structure. Structures assumed in this study were either aerial (typically joint use on an existing aerial line), or below ground in conduit.

Unit costs (\$/ft) for aerial structure vary based upon whether there is an existing, adequate joint use line, or whether the line must be reinforced or extended, or be newly built. Variables which drive unit costs for below-ground conduit include the type of surface (e.g. asphalt, concrete, sod, etc.), the type of soil (e.g. sand, calciche, rock, dirt, etc.), the type of construction (e.g. trenching, boring, plowing, etc.), the depth at which the cable is to be placed, the location of existing buried utilities (sewer, water, gas, etc.), backfill requirements, restoration requirements, the need for additional utility holes to access backbone routes, and permitting costs. Other impacts, such as the need to perform work during non-peak traffic hours, may apply, depending on the jurisdiction and the season.

Fiber cable costs were based on length calculations; described below; multiplied by a cost per foot loaded to include estimated costs of installation.

ASSUMPTIONS:

Building entrances – it was assumed that each location will require a new building entrance, whether aerial or below ground.

Path types – it was assumed that the mix of aerial versus buried plant identified for locations sampled, could be applied to the entire population of customer locations, again, by distance band.

Depths for below ground paths – a depth of four feet from the surface was assumed.

Joint paths for adjacent locations – a portion of most paths from backbone routes to locations are shared between adjacent locations, or among multiple locations that lie near a common path. It was assumed, on the basis of the experience of a knowledgeable local contractor, that on average, path costs developed on a "stand-alone" basis for each location, should be reduced 40% to reflect this cost sharing effect, to reach a true average path cost per location.

Access to backbone routes - it was assumed that a utility hole would need to be added for splice access to the backbone fiber route, for buried paths, if there were no observable access points within 500' of the point on the backbone fiber nearest the probable path to the location.

Utility holes - for most locations, access to the existing CAP fiber route is readily available via existing utility holes or aerial splice enclosure. However, in many cases access would require placing a new utility hole. The proportion of sample locations, by band, for which additional utility holes would be needed, was calculated. This proportion was applied to the total population of locations within the band to the utility hole component of total path costs.

Utility hole sharing among multiple paths - every splice in a fiber-optic cable creates a loss of signal strength. To minimize these losses, the number of splice locations along backbone fiber routes must be minimized. This requires that the number of access points for paths to customer locations also be minimized. As a result, each access point along the route is typically used to connect multiple paths leading from the backbone route to customer locations. It was assumed, on the basis of PEI's experience and that of a local contractor, that on average, four paths to locations would be connected to the backbone route at each utility hole. To account for this sharing factor in the cost calculations, utility hole costs developed for "stand-alone" paths were multiplied by 25% to yield an average utility hole cost per location.

Utility hole summary - the observations outlined above led to a procedure in which average utility hole costs per location for all of locations, by airline distance band, were derived by multiplying the cost of a single hole by two factors. First, the cost of a hole was multiplied by the percentage of locations requiring a new hole, and then by a factor to account for sharing of holes by multiple paths (see Item 12. ESTIMATING PROCEDURE below for other utility hole cost calculations).

Fiber-optic cable - it was assumed that 24-fiber count, single mode fiber-optic cable would be used to connect the locations to the CAP fiber routes. This size provides adequate facilities for the four-fiber connections necessary for automatic alternate routing, plus growth. A local contractor advised that this is a typical size and type used for this purpose. Note that frequently, a larger size may be used for some distance from the backbone route, when several customers are located in adjacent quarters. Because the unit costs (cost per foot per fiber) drops as size increases, actual cable costs per customer are lower than those calculated for the study.

ESTIMATING PROCEDURE:

Structure Costs:

It was noted that algorithms could readily be applied via computer, to the entire population of locations in U S West's data base, which would identify the airline distance from each location to the nearest CAP fiber cable route. PEI elected to develop a cost estimating model related to this airline distance, which could then be readily applied to the entire database via software. Even though actual path lengths vary significantly from the airline distance, by costing a statistically valid number of randomly selected sample locations in

each band, an average path cost by band can be established with sufficient accuracy for overall budget planning.

Throughout the process, the experience of PEI and an experienced local contractor were used to develop estimates and assumptions.

The process used was as follows:

1. U S WEST's geographic databases of hi-cap service locations and CAP fiber-optic cable routes were provided to Power Engineers (PEI). Data included the address, and the number and type of hi-cap services by location, and the running lines of CAP "backbone" fiber routes.
2. PEI distributed the locations into one thousand foot distance bands from the nearest CAP fiber route, e.g. 0 to 1,000 ft: 1,001 to 2,000 ft. etc., using geographic information systems (GIS) software.
3. It was observed that more than half of the locations were within 1,000 ft of a CAP fiber route, and that the population fell rapidly with distance, fewer than 10% being beyond 4,000 ft. This led PEI to assume that CAPs would be unlikely to extend fiber beyond 9,000 feet, since costs increase with distance and there are few such locations.
4. A first approximation was made of path cost variation within each band for the purpose of setting initial sample size. This was based on estimated variations in distance within the band from the location to the nearest access point on the nearest CAP fiber route, and from the expected variation in unit costs for the different types of construction and terrain.
5. The rough estimate of potential cost variation by band was used to determine the number of sample locations to be studied within each band, to achieve a 95% confidence level for the average path cost within the band. The rough estimate was later validated and refined, based on cost variations observed among the sample locations.
6. The appropriate number of sample locations was chosen in each band using a random process.
7. Field visits were made to each location in the sample to obtain site specific data:

Distance along a reasonable path from the property line of the location to the nearest access point on the nearest CAP fiber route (see assumptions, above).

Type of access to backbone route - would a utility hole need to be added?

Distance from the property line to the nearest building wall at the location.

Distance from the building wall to the equipment room was estimated to be half the width of the building.